on account of the excess of oily matter always present in the field. The contents of the cells are highly granular in all cases; the outline of the cells is flat and indistinct; nuclei are rare and faint; there is usually a large quantity of granular matter in the field. These cells may in fact be regarded as in a state of fatty metamorphosis, and as directly derived from the sebaceous glands, and the affection has evidently a much closer affinity with seborrhœa oleosa than with the affection known as seborrhœa sicca capitis.

ART. VII.—*A Contribution to our Knowledge of Beef-tea.* By HORACE BINNEY HARE, M.D., Physician to the Episcopal Hospital, Philadelphia.

THE general use which has been made of the various forms of beef-tea, and the difference of opinion with regard to its value, seem to me to justify the belief that some addition to our knowledge of the composition of the forms most commonly in use will be of interest to the profession.

While working in the Chemical Laboratory of the Pathological Institute in Leipzig, under the direction of Professor F. Hofmann, I was led to make certain analyses of what is commonly known as Beef Extract made according to the receipt given below. During the past winter I pursued the investigation further, and now present the results of my analyses.

As will be seen by a glance at the tables, only the amount of albumen and salts was directly estimated, while the figures given under "other organic matter" were obtained by subtraction of the albumen known to be present from the amount of organic matter found by incineration.

In the soups made without heat no gelatin was to be expected, and in the others, if any was present, which is to be doubted, it has been estimated together with the albumen and colouring matter.

The method of analysis employed, chosen after some experiment, was the same in each case. After the preparation of the soup, a weighed quantity of it was treated with a large excess of alcohol, enough in each case to precipitate the albumen completely. The mixture was allowed to stand twenty-four hours, then filtered, the albumen dried and weighed, then incinerated, and the weight of the ash subtracted. When the soup contained fat, which was, however, the case only when heat had been employed in its preparation, this was carefully removed after the liquid had grown cold and before the analysis was begun.

Another portion of the soup was weighed, evaporated to dryness, and the solid matter thus obtained. The solid matters incinerated gave the relative amounts of organic and inorganic matter.

In Table A will be found the results of the analysis of what I have termed Beef Extract, which was prepared, according to the usual receipt, as follows: Meat which had been as far as possible deprived of its fat and tendinous matter, by scissors, was cut up in very small pieces, weighed, and placed in a jar loosely stoppered. This jar was then placed in a vessel containing cold water, which was gradually brought to the boiling point.

TABLE A.—*Analysis of Beef Extract.*

	I.	II.	III.	IV.	Average.
Grammes, meat	699	362	450	795	
" soup	245	152	179	267	
Composition of soup—					
Water	92.90	93.72	92.62	92.57	92.95
Solids	7.10	6.28	7.38	7.43	7.04
100 parts solids—					
Organic	78.88	79.53	80.84	81.40	80.16
Salts	21.12	20.47	19.16	18.60	19.84
100 parts soup—					
Water	92.90	93.72	92.62	92.57	92.95
Albumen and coloring matter	1.71	1.39	1.60	1.18	1.47
Other organic matter	3.90	3.61	4.37	4.87	4.18
Salts	1.49	1.28	1.41	1.38	1.39
Extracted from 100 parts meat—					
Albumen and colouring matter	0.59	0.58	0.63	0 39	0.54
Other organic matter	1.36	1.51	1.73	1.63	1.55
Salts	0.52	0.78	0.56	0.46	0.58

When the meat had lost its red colour and become blanched—a result usually obtained at the end of two hours—it was removed, thoroughly pressed, and the fluid which was obtained, added to what had collected in the jar, passed through a hair-sieve. This soup has an extremely pleasant taste, and is, as is well known, much relished by patients. It is comparatively rich in the salts of meat, poor in albumen, and, as can be seen by reference to the table, extremely expensive, 100 parts of meat yielding but 36.54 parts of soup. As in the other tables, the amount of each ingredient obtained from 100 parts of meat is given, that the relative expense of the different soups may be seen.

The beef-teas of which the analyses are given in Table B. were made according to the receipt of Dr. Pavy, which varies hardly at all from that of Dr. Letheby, excepting that more heat is likely to be applied under the directions of the latter, and a soup obtained having, if possible, less value.

As will be seen by the tables, varying quantities of water were employed, but Number III. is the analysis of a soup prepared according to the directions in Dr. Pavy's book.

I give the receipts of these two gentlemen with their remarks.

Table B.—*Analysis of Pavy's Beef-tea.*

	I.	II.	III.
Grammes, meat	367	450.5	363
" water	753	530.3	364
" soup	799.8	679.6	512
Composition of soup—			
Water	97.32	96.71	97.38
Solids	2.68	3.29	2.62
In 100 parts solids—			
Organic	82.40	80.12	80.55
Salts	17.60	19.88	19.45
In 100 parts soup—			
Water	97.32	96.71	97.38
Albumen and colouring matter	0.81	0.74	0.98
Other organic matter	1.40	1.89	1.13
Salts	0.47	0.66	0.51
From 100 parts meat—			
Albumen and colouring matter	1.76	1.11	1.38
Other organic matter	2.99	2.85	1.32
Salts	1.01	0.99	0.72

Dr. Letheby[1] says:—

"The richest of all soups is obtained from finely chopped lean meat, soaked for an hour or so in an equal weight of cold water, and then gradually raised to the boiling point. After simmering for about a quarter of an hour, it should be pressed and strained from the insoluble muscular fibre. In this condition it contains the whole of the soluble constituents of meat, amounting to about five per cent. of the meat used; so that a pint of soup from a pound of meat contains just four-fifths of an ounce of meat extract."

Dr. Pavy[2] gives a similar receipt:—

"Mince finely one pound of lean beef, and pour upon it, in a preserve jar or other suitable vessel, one pint of cold water. Stir, and allow the two to stand for about an hour, that the goodness of the meat may be dissolved out. Next stand the preserve jar or other vessel in a saucepan of water, and place the saucepan over a fire or a gas stove, and allow the water in it to gently boil for an hour. Remove the jar, and pour its contents on to a strainer. The beef-tea which runs through contains a quantity of fine sediment, which is to be drunk with the liquid after being flavoured with salt at discretion. The jar or other vessel in which the beef-tea is made may be introduced into an ordinary oven for an hour, instead of being surrounded by the water in the saucepan. Beef-tea thus prepared represents a highly nutritive and restorative liquid, with an agreeable rich meaty flavour. It is a common practice amongst cooks to make it by putting it into a saucepan, and boiling it or simmering it over a fire; but the product then yielded constitutes in reality a soup or broth instead of a tea."

He also states that "all that is wanted is that the cold infusion should be heated to about 170° Fahrenheit. This just suffices to coagulate the albumen and colouring matter, and thus deprive the product of its character of rawness."

This is true; but it is far better to deprive the soup of its raw character when we can preserve the albumen. This cannot, as far as my experience goes, be done without first removing the meat from the soup.

If this is attended to, we get the soup of which the analyses are found in Table C.

---

[1] On Food, by H. Letheby, M.A., Ph.D., etc., 2d edition, New York, 1872, p. 170.

[2] A Treatise on Food and Dietetics, by F. W. Pavy, M.D., F.R.S., London, 1874, p. 511.

TABLE C.—*Analysis of Cold Extract of Beef.*

	I.	II.	III.	Average.
Grammes, meat	338	393	449	
" water	340	393	449	
" soup	355.2	470	464	
Cubic centimetres, soup			455	
Composition of soup—				
Water	96.09	96.70	95.53	96.11
Solids	3.91	3.30	4.47	3.89
In 100 parts solids—				
Organic	86.87	84.39	88.28	86.51
Salts	13.13	15.61	11.72	13.49
In 100 parts soup—				
Water	96.09	96.70	95.53	96.11
Albumen and colouring matter	2.53	2.78	2.56	2.545[1]
Other organic matter	0.87		1.31	0.82[1]
Salts	0.51	0.52	0.52	0.516
From 100 parts meat—				
Albumen and colouring matter	2.65	3.32	2.64	2.645[1]
Other organic matter	0.92		1.35	1.12[1]
Salts	0.57	0.62	0.53	0.55

It is not uncommonly used, and is mentioned by Lady Barker in her little work on cookery.

The best method for obtaining this is, I believe, the following :—

A pound of meat, previously freed from fat and tendinous matter (for which purpose scissors will be found very convenient), is cut in small pieces, by a sausage-meat cutter when possible, and then allowed to stand covered with its own weight of water. The meat and water should be stirred from time to time, and kept in a room at the ordinary temperature. Heating the mixture moderately, hastens the process, though it has no other advantage, and has to be done with so much care that in ordinary hands it had best be avoided. At the end of two hours, or when the meat seems blanched, the clear red fluid is poured off, the meat thoroughly pressed in a cloth, or, when much has to be made, in a small press such as is used by druggists, the fluid from the meat added to that previously poured off, and the whole brought just to the boiling point. When boiled, the albumen shows a tendency to form a large clot. This must be broken up by rapid stirring with a fork. When allowed to stand we have a clear fluid of a pale yellow colour, at the bottom of which lies a quantity of very finely divided albumen. Before pouring the soup out for use it must, of course, be thoroughly stirred.

---

[1] Average of I. and III.; owing to accident, the albumen was not determined directly in II.

TABLE D.—*Analysis of Cold Extract of Beef with* 50 *per cent. Additional Water.*

	I.	II.	Average.
Grammes, meat	448	458.7	
" water	672	668	
" soup	592[1]	720.8	
Cubic centimetres, soup	580	715	
Composition of soup—			
Water	96.22	96.16	96.19
Solids	3.78	3.84	3.81
In 100 parts solids—			
Organic	87.	88.27	87.635
Salts	13.	11.73	12.365
In 100 parts soup—			
Water	96.22	96.16	96.19
Albumen and colouring matter	2.39	2,38	2.385
Other organic matter	0.89	1.01	0.95
Salts	0.49	0.45	0.47
From 100 parts meat—			
Albumen and colouring matter	3.16[1]	3.74	3.45
Other organic matter	1.17[1]	1.58	1.375
Salts	0.64[1]	0.71	0.675

TABLE E.—*Analysis of Cold Extract of Beef with* 100 *per cent. Additional Water.*

	I.	II.	III.	Average.
Grammes, meat	456.2	407	405	
" water	919.5	814	810	
" soup	954	792	810	
Cubic centimetres, soup	950	790	800	
Composition of soup—				
Water	97.01	97.31	97.33	97.216
Solids	2.99	2.69	2.67	2.783
In 100 parts solids				
Organic	86.70	87.90	87.06	87.22
Salts	13.30	12.10	12.94	12.78
In 100 parts soup				
Water	97.01	97.31	97.33	97.216
Albumen and colouring matter	1.87	1.41	1.68	1.653
Other organic matter	0.72	0.96	0.65	0.776
Salts	0.40	0.32	0.34	0.353
From 100 parts meat—				
Albumen and colouring matter	3.91	2.76	3.36	3.343
Other organic matter	1.50	1.62	1.30	1.473
Salts	0.84	0.62	0.68	0.713

As regards taste, the soup is by no means inferior to that made with water and heat, although it is in this respect in no way comparable to that made, as in A, without water.

In order to see whether it was possible to decrease the expense of the beef-tea without impairing its nutritive properties, I have tried varying proportions of water, as will be seen by reference to Tables D and E. In D, the meat was treated with one and one-half times its weight of water;

---

[1] I. was pressed less than II. and hence a less yield for the beef employed. The loss in albumen, etc., is nearly proportional to that in the quantity of soup.

in E, with twice its weight. The results are given, and from them I should prefer to use one and one-half pounds of water for each pound of meat, the process of preparation being precisely that given under C.

Although containing a vastly greater amount of albumen than the beef-extract A, this beef-tea contains less salts and extractives. In order to supply its deficiencies in this respect, and at the same time increase its percentage of salts, I would suggest the addition of a given amount of Liebig's extract. This, as is well known, contains no albumen and as little gelatin as possible, but is rich in salts and in organic matters.

Its percentage composition, as given by Letheby, is—water, 18.56; extractives, 59.36; salts, 22.08. The percentage of inorganic salts in the beef-tea made without water, which may fairly be taken as a standard of flavour, is 1.39, and of organic matters not albumen 4.18. If, therefore, we add to 100 parts by weight of soup, made as in D, about 5 parts of Liebig's Extractum Carnis, we get a soup containing about 1.4 per cent. salts and nearly four per. cent. of organic matter not albumen, in addition to the 2.3 per cent. of albumen. The addition of Liebig's extract improves the colour and adds to the flavour—both matters of importance.

To accomplish this result it would be necessary to add to every pint of beef-tea, made according to D, about six drachms of Liebig's South American extract. Of course, any other proportion may be used, and any desired amount of salts and extractives be administered. I may mention that a drachm of Liebig's Extract filled an ordinary teaspoon, which I used, level with the edge.

Liebig's beef-tea, the formula for which is taken from Dr. Pavy, is made as follows:—

Take half a pound of raw lean beef (chicken or any other meat may be similarly used) and mince it finely. Pour on to it, in a glass or any kind of earthenware vessel, three-quarters of a pint of water, to which have been added four drops of muriatic acid and about half a saltspoonful of salt. Stir well together, and allow it to stand for an hour. Strain through a hair sieve, and rinse with a quarter of a pint of water. It is to be taken cold, or, if warmed, must not be heated beyond 120° Fahr.

It will be observed, Dr. Pavy remarks, that no cooking is here employed, and although much richer in nutritive material and more invigorating than ordinary beef-tea, the raw-meat taste that it possesses sometimes causes it to be objected to.

In Table F, I have given the results of analyses of beef-tea made with the addition of 1 cubic centimetre of hydrochloric acid, but without salt. They cannot, therefore, be taken as fair examples of Liebig's soup, but show a large percentage of albumen. I see no good reason why this should not also be heated to the boiling point before administration, if the patient objects to it in its raw form—but hope to have the opportunity of continuing my investigation of the subject further.

Table F.—*Analysis of Beef-tea made with Hydrochloric Acid.*

	I.	II.	III.	Average.
Grammes, meat	455.6	419	421.5	
" water	460.1	419	421.5	
" soup	484.7	402.5	416	
Cubic centimetres, soup	475	400	415	
Composition of soup—				
Water	94.92	95.34	95.62	95.29
Solids	5.08	4.66	4.38	4.70
In 100 parts solids—				
Organic	88.62	89.01	88.55	88.72
Salts	11.38	10.99	11.45	11.24
In 100 parts soup—				
Water	94.92	95.34	95.62	95.29
Albumen and colouring matter	4.50	3.03	2.86	4.14[1]
Other organic matter		1.12	1.02	
Salts	0.58	0.51	0.50	0.53
From 100 parts meat—				
Albumen and colouring matter	4.78	2.91	2.82	4.14
Other organic matter		1.07	1.00	
Salts	0.61	0.49	0.49	0.53

In conclusion, although the calculations of the percentage from 100 meat are marred by the error inseparable from any means which I possessed of expressing the soup, I think it hardly large enough to prevent conclusions of some value from being drawn from them.

If beef-tea be made according to the receipt of Dr. Pavy, it is probable that not more than 1.5 parts of albumen are derived from 100 parts of meat; while by the cold process under D, not less than 3 per cent. are obtained.

If, therefore, the composition of the first is satisfactory, and we may content ourselves with these quantities of albumen, the same result may be attained by the use of half the amount of meat—a very considerable saving; while if, as is more probable, we wish to administer as much food as possible, we obtain in the cold process not only a greater percentage of albumen, but a considerably greater quantity of soup.

I may add that since from the analyses published it would seem, to say the least, rare to find cow's milk containing more than 3.03 per cent. of casein and albumen taken together, or than 0.78 per cent. of salts; the results of my analyses of beef-tea render it fair to infer that the latter, properly made, falls but little behind milk in value as food so far as these ingredients are concerned, though it will require, of course, physiological experiment to decide the question absolutely.

---

[1] Average albumen for II. and III. 2.94; per 100 meat, 2.86.